L Number	Hits	Search Text	DB	Time stamp
1	3553	((ARC or antireflective or BARC) with (silicon or polysilicon))	USPAT; US-PGPUB	2004/10/05 13:52
2	1747	(((ARC or antireflective or BARC) with (silicon or polysilicon))) and (resist or photoresist)	USPAT; US-PGPUB	2004/10/05 13:53
3	255	((((ARC or antireflective or BARC) with (silicon or polysilicon))) and (resist or photoresist)) and ((remove or removing) with plasma)	USPAT; US-PGPUB	2004/10/05 13:53
4	104	((((ARC or antireflective or BARC) with (silicon or polysilicon))) and (resist or photoresist)) and ((remove or removing) with plasma with (resist or photoresist))	USPAT; US-PGPUB	2004/10/05 13:53
5	67	(((((ARC or antireflective or BARC) with (silicon or polysilicon))) and (resist or photoresist)) and ((remove or removing) with plasma with (resist or photoresist))) and @ad<20020219	USPAT; US-PGPUB	2004/10/05 13:54

US-PAT-NO: 6191046

DOCUMENT-IDENTIFIER: US 6191046 B1

TITLE: Deposition of an oxide layer to facilitate photoresist rework on polygate layer

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Brief Summary Text - BSTX (7):
Reworking or re-patterning a photoresist of an IC device is economically desirable, as compared to scrapping the wafer, when there is at least one correctly constructed lower layer (e.g., a silicon wafer) already formed beneath a photoresist layer. However, the process of stripping the photoresist pattern layer or portion thereof may result in damage to or change a top monolayer of oxide portion of an anti-reflective coating (**ARC**) which lies on top of a **polysilicon** layer. A change in the monolayer may result in exposure dose change as well as interaction of the deep UV photoresist with the ARC material.

Brief Summary Text - BSTX (8):
More particularly, a top monolayer of a **silicon** oxy-nitride **ARC** is converted into an oxide by N.sub.2 O plasma to prevent nitrogen contact with the photoresist layer formed over the **ARC**. Nitrogen contact with the photoresist may result in undesirable footing problems (non-uniform structure). Thus, the oxide monolayer serves as a barrier between the photoresist and nitrogen portion of the ARC. Such a monolayer works fine during an intial photoresist application and photolithographic process. However, if the

photoresist needs
to be reworked the plasma and chemical process employed in the rework to strip
the photoresist may result in removal of the oxide monolayer. Consequently,
nitrogen bonds of the silicon oxy-nitride may react with a newly applied
chemically amplified deep UV photoresist resulting in footing problems in the
new photoresist layer.

Detailed Description Text - DETX (6):
Any suitable technique for depositing the oxide layer 26 may be employed
such as LPCVD, PECVD, atmospheric pressure chemical vapor deposition (APCVD),
or high density plasma chemical vapor deposition (HDPCVD) techniques such as
electron cyclotron resonance (ECR), inductor coupled plasma (ICP), transformer
coupled plasma (TCP) and helicon plasma. The oxide material is deposited over
the ARC 25 in order to form the oxide layer 26 thereon. The oxide layer 26
forms a protective coating or seal over both the **ARC** 25 and the underlying
polysilicon layer 24. As is further discussed below, the oxide layer 26 serves
to protect the **ARC** 25 and the **polysilicon** layer 24 from the detrimental effects
which may be experienced during rework of an overlying photoresist layer.

Detailed Description Text - DETX (15):
A circuit image of any desired pattern is next formed within the resist
layer by exposure of the resist layer to radiation through an appropriate
photolithographic mask or by controlled laser, ion beam or electron beam energy
sources, followed by suitable development to remove the exposed or unexposed
areas of the resist, depending on the resist chemistry. The development step
exposes that portion of the oxide layer 26, the **ARC** 25 and the **polysilicon**

layer 24 which are to be etched away during later processing stages, while the remaining portions of the surface 26 continue to be masked by the resist. Positive resist materials (e.g., novolac resin types) are preferred for this invention since they may be developed using aqueous alkaline developer materials such as alkali or alkaline earth metal hydroxide or metal-silicate aqueous solutions (e.g., 0.2 N KOH).

Detailed Description Text - DETX (19):

The processes available for reworking an IC depend in large part upon the composition of the incorrectly patterned or defective layer which is to be removed. For example, if photoresist layer 28 is composed of a novolac resin type photoresist material, a defective or incorrectly patterned photoresist layer 28b can be removed by ACT-935, followed by washing with water and then a **plasma** strip to completely **remove** the defective or incorrectly photoresist layer 28b. As can be seen in FIG. 1c, the removal portion of the reworking process is graphically illustrated by arrows 32.

Detailed Description Text - DETX (20):

As discussed above, during rework a conventional oxide monolayer of an **ARC** would also be stripped or partially stripped during rework thus exposing portions of the **silicon** oxy-nitride **ARC to a photoresist** to be newly applied. The nitrogen of the ARC may creating undesirable footing problems in the new photoresist. The present invention mitigates such problems by employment of the oxide layer 26 formed in the manner discussed above. The oxide layer 26 acts as a protective layer to serve as a barrier to nitrogen contamination of the photoresist 28 by the ARC 25. The oxide layer 26 has a thickness which

affords for sufficient oxide layer 26 to remain after a photoresist stripping process such that the remaining oxide layer 26 still prevents nitrogen contamination of the newly applied photoresist layer. As a result an increase in production yield is realized due to the ability of IC devices with incorrectly patterned photoresists to be reworked.

Claims Text - CLTX (16):

9. The method of claim 7, wherein the step of **removing** the patterned photoresist layer and a portion of the oxide layer is accomplished by sequentially using ACT-935, water and **plasma** stripping.